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ABSTRACT

A distinction is drawn between pragmatic and semantic meaning and a supporting discussion is presented. The hypothesis is then stated, that there are cases where semantic meaning of an utterance is learned as an abstraction from pragmatic meaning. Data from two experiments on a group of 63 preschool children are presented which provide empirical support for the hypothesis in the case of the spatial prepositions "under," "underneath," and "below." The implication of these data is that the competence which distinguishes the competent native hearer-speaker of a language from others has as much to do with pragmatics as with syntactics. (Author)

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Where is 'under?' The Development from Pragmatic to Semantic Meaning

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Where is 'under?'

The Development from Pragmatic to Semantic Meaning

The research reported in this paper concerns the understanding by young children of spatial prepositions. The findings I shall present constitute one piece of evidence in support of an hypothesis that semantic meanings develop from pragmatic meanings. In making the disjunction between pragmatic and semantic I am following Charles Morris (1955) who divides linguistics into syntactics: the relation of signs to signs, semantics: the relation of signs to meaning, and pragmatics: the relation of signs to behavior. I would define pragmatics more generally than Morris as the relationship of signs to the personal relations, physical environment, action, behavior context. By signs I mean words, which for the most part is what Morris's writing is about also.

Pragmatics and Semantics

A little more needs to be said to clarify the distinction which I see between pragmatics and semantics. My basic interest is in how children acquire understanding of language and its use, looked at developmentally. I will state here, and in the course of this paper provide some empirical evidence that children learn pragmatic meanings of utterances before they learn the meanings of the sentences in the English language, i.e., the semantic-syntactic meaning. First, I want to mention types of utterances for which the relationship between pragmatic and semantic meaning does not hold. These are instances in which there is essentially no relationship between pragmatic meaning and the meaning of the utterance in the English language.

(1) For some utterances, the pragmatic meaning is all the meaning the utterance has. For example, 'oops' said by a mother when she drops things may be understood by her young child to have a pragmatic or occasion meaning as the accompaniment to a particular behavior, dropping things.

(2)De Villiers and Flusberg (1976) report the importance of plausibility in children's response latencies when asked for negative judgments as to the name of an object. Plausibility is not a syntactic or semantic category; it is rather a pragmatic one. Negative statements are generally used to point out a discrepancy between a listener's presumed expectations and the facts. Children in De Villiers and Flusberg's experiment had difficulty responding to implausible negatives because in their experience, people only said, 'this is not an X' when there was a reason for thinking the object being identified might have been an X. Wason (cited in De Villiers and Flusberg) has reported the same finding for adults.

(3) I have presented findings (1972, 1974) that children learn the pragmatic meaning for sentences their mothers use in successfully guiding their behavior and that this meaning is not the same as, nor deducible from, the semantic-syntactic meaning of the sentences, but is deducible from personal relations, action-context information. These findings have led me to hypothesize that the child's learning of pragmatic meaning precedes his/her learning of semantic-syntactic meanings. I think researchers may have failed to entertain this possibility because pragmatics is not an aspect of linguistics that has received a great deal of attention and because of the overlap between pragmatic and semantic meanings in many cases. This paper is concerned with the development of

meaning in these cases. The meaning of an utterance for a child develops as the child hears and notes the personal relation, physical environment, action contexts in which it occurs. The pragmatic meaning is situation bound. The semantic meaning is an abstraction which yields to definition in terms of synonymy, antinomy, class membership and other bases for categorization. One of the (many) remarkable characteristics of children is that they form hypotheses about the semantic meanings of utterances from their pragmatic meanings. We are aware of this primarily because of the errors in the children's hypotheses. As Anglin (in press) and Reich (1976) have pointed out, we are more likely to notice some kinds of errors than others and this has lent support, for example, to theories of semantic development as the progressive acquisition of semantic features (e.g. Clark, 1973). That is, Clark theorizes that initially the meaning of a word is overextended by the child because fewer semantic features are associated with the word than necessary to articulate its precise meaning. For example, 'Bow wow' was found by Clark, using as data diary studies by parents, to be used initially by several children as the label for a variety of four footed animals including dogs, cats, horses and cows.

By and large, meanings are not learned on the basis of the child's being told the abstract, semantic meaning of a word. The adult says, "There's a Bow wow", pointing to one. The adult does not say to the young child, "I am going to tell you what a Bow wow is. It is a furry animal with four legs that says 'Bow wow' that people keep as pets." This is a simple definition suited to the young child's comprehension,

so it is not that abstract semantic meanings are necessarily too difficult for young children. Rather, it is not the way young children seem to learn about the world. The sensory-motor way, learning by doing, is the usual way, specifically in the case of learning language, learning by hearing utterances in the normal course of events, as a part of the events.

The analysis of the development of 'Bow wow' derived from the hypothesis that semantic meaning comes about as an abstraction from pragmatic meaning is that in one or more instances someone said to the young child, "See the Bow wow," "There's a Bow wow," etc., as a dog came into the child's view. This is the pragmatic way of acquiring a meaning. The label is learned in relation to the occurrence of particular speech acts, in this case, a report. The label could have been learned in relation to other speech acts serving other pragmatic functions, e.g. "Pet the nice Bow wow," a suggestion. In fact, for most children, until they go to school at least, almost all meanings are learned on a pragmatic basis and an hypothesis as to semantic meaning is precipitated out on the basis of some number of pragmatic encounters.

Because meaning derives from pragmatic encounters, the hypotheses generated by children as to the semantic meaning of the word are likely not to exactly coincide with the generally accepted semantic of the word. It depends on the particular circumstances. A young child growing up on a farm is more likely to have the pragmatic encounters that prevent the overextension of 'Bow wow' to include cats, horses and cows.

Under-extension of a label is likely to go unnoticed by parents because the child, when it uses the word uses it correctly. There are other kinds of errors made by children--the mismatch and overlap errors--identified by Reich for example. I believe that in addition there are errors of interpretation made by adults when they attribute to a child semantic meaning for a word which has only pragmatic meaning for the child, e.g. Reich's discussion of his son Adam's abilities as an 8 month old. In the context of a game in which Adam was asked,"Where's the X?" he would crawl to X if X were his mother or his bed. If X were 'shoes' he would crawl to his mother's closet and play with the shoes in it. No shoes, except shoes in his mother's closet would be sought by Adam, initially. At this point I would say that 'shoes' had only a pragmatic meaning in the personal relations, physical environment, action context in which he and his parents played the 'Where's the X' game.

> When some of Mommy's shoes were placed outside the closet Adam would crawl around them to get to the closet door, then open the door to get to the shoes. Thus shoes on the floor in front of the closet were not 'shoes'. Similarly, when Adam was placed at point Z with Daddy's closet door open he would not stop to play with the shoes on the floor of Daddy's closet....At approximately two week intervals, the concept associated with the term expanded as follows; at the next stage, shoes in Daddy's closet were also shoes, but not shoes on the bedroom floor. Then shoes on the bedroom floor were also 'shoes' but not the same shoes if they were being worn. Finally shoes being worn were also included (Reich, p. 120).

Reich says that at this point the parents tired of the game and do not know about the further expansion of the meaning of shoe. At this point 'shoes' has been shown to have only the pragmatic meaning associated with playing 'Where's the shoes?' albeit the pragmatic category

has expanded. I propose that the term semantic should be reserved for meanings that are not tied to the pragmatic context in which the utterances have been heard by the child in order to distinguish words which have only pragmatic meaning from those which have semantic meaning.

The pragmatic way of acquiring meanings can be contrasted with what I would take to be the alternative way, using a dictionary or having words defined for one. Notice that this way works best, in the sense of the definitions being remembered, when the learner has a need for or interest in the definition as the result of some activity he is carrying out, a pragmatic interest.

The work I have cited of Anglin, Clark, and Reich dealt with the child's learning of referents for physical object words. This is the class of words for which parents are most likely to provide pragmatic situations in which the relationship of word and referent are reported to the young child. Spatial prepositions are more likely to be learned without explicit teaching on the part of parents and are of interest for this reason. Relational terms, including spatial prepositions, are more abstract than names for physical objects and their learning seems more problematic. It was for these reasons that I undertook a study of young children's comprehension of spatial prepositions.

Experiments with Spatial Prepositions

The prepositions, the understanding of which I investigated, are 'on', 'next to', 'in', 'underneath', 'behind', 'over', 'outside of', 'below', 'between', 'in front of', 'above', 'beside', 'inside', 'under', and 'out of', a total of 15 prepositions. Comprehension of the prepositions

was tested in the context of a game in which the child placed Cookie Monster in locations consonant with the prepositions. When this research was undertaken, the hypothesis that pragmatic meanings precede semantic meanings in the child's understanding and that semantic meanings are abstractions from pragmatic meanings had not occurred to me. In fact the results of this experiment played a large role in my arriving at this hypothesis.

EXPERIMENT I

Subjects

A total of 70 subjects participated in this first experiment. The age and sex composition of the sample is given in Table 1. The subjects were all enrolled in a laboratory children's school which strives for diversity of race and socio-economic status in its school population.

Insert Table 1 about here

Procedure

The experimenter and child were seated next to each other facing the structure for the first experiment (see Figure 1). The experimenter placed

Insert Figure 1 about here

Cookie Monster (a stable 2¼ inch high replica of the Sesame Street muppet) in every location that corresponded to the locations indicated by the 15 prepositions. The experimenter said, "See, Cookie Monster can go here," placing Cookie Monster in the box, which was colored red (while the rest of the structure was blue) and was glued to the middle shelf. This procedure was continued until the experimenter had indicated all the locations corresponding to the prepositions. The experimenter then handed Cookie

Monster to the child and said, "Now you put Cookie Monster wherever you like." Children uniformly placed Cookie Monster someplace in the structure. The child was then asked to point to the red box to make sure he knew the reference point for the prepositions. Following this the experimenter said to the child, "Put Cookie Monster in the red box." After the child had placed Cookie Monster in the red box (all children were successful with 'in'), the locations for the remaining fourteen prepositions were asked in the order: on, next to, underneath, behind, over, outside of, below, between (the red box and the side of the structure), in front of, behind, beside, inside, under, and out of.

Results

For the 70 children, there were a total of 1050 responses, and only 121 of these were errors. Table 2 shows both the number of children who made errors on each preposition and the nature of the incorrect responses, i.e., of the 25 children who erred on 'underneath', 10 put Cookie Monster in the red box; one, next to the red box; 6, behind the red box; and 8 made no response.

Insert Table 2 about here

The errors made by the children were not randomly distributed over the fifteen prepositions. They were heavily concentrated. At least 20 percent of the children (fifteen errors equals 21% of the children) made errors on underneath, below, over, and under. The results of the second experiment, to be described below, provide some clues to the understanding of this concentration of errors which support the hypothesis--pragmatic meaning, then semantic. The types of incorrect responses also provide evidence for the hypothesis in connection with the second experiment. This hypothesis will be discussed after the second experiment is described. Notice that the types of incorrect responses involve only five of the 15 prepositions plus no response.

Evidence from this experiment for the semantic marking feature theory of Eve and Herbert Clark (1973) is equivocal or negative. Fewer errors were made on 'above', the unmarked preposition, than on 'below', the marked (6 and 22); roughly the same number on 'over', unmarked and 'under', marked (15 and 18); but more on 'in front of', unmarked than on 'behind', marked (13 and 7). Thus, evidence for the learning of the 'visible' (unmarked) member of of a pair before the obscurred (marked) member is equivocal. Of the 22 children who made errors on 'below' (marked), none responded with 'above' or 'over' and only one with 'on' (unmarked opposites of 'below'). Of the children who responded incorrectly to 'behind' (marked), none picked 'in front of' (unmarked). Four of the 13 who responded incorrectly to 'in front of' picked 'behind'. None of the children who missed 'under'(marked) picked 'over', 'on', or 'above'(unmarked opposites). Thus evidence is negative that after children learn the meaning of the unmarked term, they will think the marked one has the same meaning. In sum, at the conclusion of the first experiment I knew of no theory that satisfactorily accounted for the findings. The experimenter (Hillel Goelman) had noted several children saying when asked to put Cookie Monster under the red box or underneath the red box, "I can't" or "It's stuck" (t red box) or "He'll get squished" (Cookie Monster) comments which suggested that for these children 'underneath' or 'under' lies between the upper surface of the middle shelf and the bottom of the red box.

If one looks at Figure 1 it can be seen that in the structure for the first experiment there was only one correct location, 6, to put Cookie Monster when the experimenter asked for 'underneath', 'under' and 'below'. To

be successful a child had to have an abstract meaning for each of the words so that location six would be seen to be correct. That is, the child had to see that location six was the only location available in the structure which conformed to the definition of each preposition. The comments by the children, like the ones reported above, suggested that if spaces more like the spaces designated 'under' and 'underneath' in the child's ordinary experience were provided, errors on these two prepositions would be reduced. Furthermore, the location 'in' was the incorrect response in twenty six of the instances in which an error was made on 'underneath', 'under', and 'below', Since the red box was glued to the middle shelf, 'in' is the location (space 3 on Figure 1) under the top of the red box. If children are accustomed to the locations 'under the table', 'under the chair', or 'under the bed', the pragmatic meaning for 'under' and 'underneath' would correspond to location 3 if the child ignored the bottom of the box, fixed to the middle shelf. The second most common incorrect response on these three prepositions was simply to give no response.

EXPERIMENT II

Our second experiment was designed to clear up the questions from the first. We were interested in the prepositions which has been most difficult on our first experiment: 'underneath', 'under', 'below','over', and 'in front of', which were the five prepositions eliciting the most incorrect responses.

We altered our structure (see Figure 1, altered structure) by ungluing the red box from the middle shelf, providing location 4 so that children could (and did) put Cookie Monster on the middle shelf and hold the red

box on or over his head. In addition we added a new shelf just below the middle shelf providing the new location, 5. We did nothing to the structure to give 'over' a pragmatic meaning. Actually, I could not think how that might be done.

We also included 'behind' in the second experiment because it is the opposite of 'in front of'. There is a line of reasoning (Sinha and Walkerdine, 1974) derived from Piaget that, initially 'in front of' is interpreted by the child to mean in front of him/herself. Errors are made with inanimate objects such that the side facing the child is called 'the front' regardless of its conventional designation, 'side' or 'back'. In our first experiment the location in our structure for 'in front of' would be correct both if the child knew the conventional meaning of 'in front of' or if he were egocentrically calling that position 'in front of' because it was directly in front of her/him. Even so there were 13 children who missed 'in front of' in comparison with only 7 who missed 'behind'.

The location for 'behind' in our structure has pragmatic meaning for children to a greater extent than 'in front of' because there is the back of the red box to put Cookie Monster behind. This is not the case with 'in front of' since the front of the box is open. In order to see whether this was a factor in making 'behind' easier than 'in front of' we removed the back of the red box for the second experiment so that the location 'behind' was behind a plane marked only by the back edges of the top, bottom and sides of the box, now open both front and rear.

Sixty-three of the original children participated in the second experiment. Procedure was the same as in the first experiment.

Results

These 63 children had made a total of 97 errors in the first experiment on the prepositions tested in both experiments. The comparison of errors of the 63 children in the two experiments is presented in Table 3. ← Insert Table 3 here

With the altered structure, errors decreased to 87 and the most dramatic changes took place with respect to 'underneath' (see Table 3). In order to understand the changes, I made a comparison of the responses of each child on the first and second experiments to 'underneath', 'under' and 'below'. First, I looked at the children who had responded with either location 3 ('in') or had given no response on the first experiment. These results are presented in part A of Table 4. It can be seen that 80% of the fifteen ← Insert Table 4 here children who had responded to 'underneath' in the first experiment with 'in' or no response, chose the newly available location, 4, in the second experiment. The others again chose location 3. The results are not so dramatic for 'under' but more than half the children chose location 4. Interestingly, all but one of the children changed their responses to 'below' but not uniformly to location 4 as in the case with 'underneath' and 'under'. These results suggest that there were at least fifteen children in our sample who had pragmatic meanings for 'underneath', 'under' and/or 'below', but who lacked a semantic for them which would have made 6 their choice in experiment 1 as it was for the majority of the children. That is, these children had meanings for 'underneath', 'under' and 'below' which are limited to situations closely resembling the ones they have encountered in their actual experience. They have what Vygotsky (1942) termed pseudo-concepts for these words. The children with a semantic meaning for the words were able to pick location 6 in the first experiment

as the only location available in the structure conforming to the abstract conditions which must be met for an object (Cookie Monster) to be underneath or under or below another object (the red box).

Having found that there were children with what I would call pragmatic meanings for these prepositions, but not abstract semantic meanings, it seemed worthwhile to look at the responses on the second experiment of the children who responded correctly with location 6 in the first experiment. These results are presented in Part B of Table 4. In the case of all three prepositions, the majority of children changed their placement of Cookie Monster from the first to the second experiment, to one or the other of the new locations. It is interesting to see differing nuances of meaning reflected in the distribution of placements for the three prepositions. 'Underneath' is overwhelmingly responded to as directly beneath, that is, twenty eight of the thirty children who responded to underneath with location 6, the bottom shelf, in the first experiment, responded in the second by lifting up the red box and putting it on or just over Cookie Monster's head. Results for 'under' are in the same direction, but not so uniform, with a quarter of the children picking the new shelf, location 5. A majority of the children picked location 5 for 'below' and only 2 of 37 picked location 4.

I have checked the definitions of the three prepositions given in Webster's New Collegiate Dictionary,(1961). They are:

'below'— in a lower place than any object, beneath.

'under'— in or to a position lower in elevation and in the same vertical line or plane so as to be overhung, surmounted, enveloped, protected or concealed by.

'underneath'-- under or below a surface or object, beneath.

'Below', 'under' and 'beneath' are identified as synonyms, 'underneath' is treated as identical to 'under'. 'Below' and 'under' are distinguished from each other as follows: "'Below' applies to that which is anywhere in a lower plane; 'under' to that which is below in a relatively vertical line; 'beneath'is a somewhat literary equivalent of both 'below' and 'under'...." What has interested me is that the three prepositions are extremely close in meaning and yet the children's responses imply that they share distinctions in meaning among the three prepositions. I would attribute these distinctions in meaning to shared, different pragmatic encounters with the prepositions. In Ellipsis in Discourse (Holzman, 1971) I argued that there were competencies in the use of language analogous to grammatical competency, which I take to be the nature of the competency Chomsky (1965) has described. Competencies in the use of language mark the native speaker-hearer as much as grammatical competency. There is substantial agreement among these children, some of whom do not even have an abstract semantic for 'under', 'underneath' and 'below' (children who responded with 'in' or gave no response to the prepositions on the first experiment) about nuances of differences among the prepositions. I would argue that this comes about because pragmatic encounters with the prepositions are similar for these preschool children. I argued in Ellipsis in Discourse that the lexicon which individuals employed for interpreting discourse was much more like a reference book than a dictionary of definitions and that the entries in the lexicon were garnered, for the most patt, from the individuals' life experiences, i.e., pragmatically; that an important source of our ability to communicate with each other was the similarity of the entries in our 'reference books', our lexicons. This similarity must be the result of similarity of pragmatic encounter which means similar experiences, similarly glossed by the accompanying discourse.

The dictionary distinction between 'below' and 'under', the necessity in the case of the latter that the two items being related lie in the same vertical plane or line, would probably not even be comprehensible to a preschooler, yet a shared distinction between 'below' and 'under' exists for our sample of children; its source is of necessity pragmatic. It is impossible to be sure what the pragmatic distinction for these children is between 'under' and 'below' but it looks as though they have encountered 'under' in situations where the objects to be related are very close vertically and 'below' in which the vertical distance is greater. The errors on 'behind' in the first experiment and the increase in errors on 'behind' from the first to second experiment provides another bit of evidence for the pragmatic then semantic hypothesis. Total errors on 'behind' increased from seven to ten and all consisted in an increase in the number of times Cookie Monster was placed next to the red box. I would like to infer from the fact that all errors on 'behind' consisted in putting Cookie monster next to the red box, that the children in our sample who erred either time on 'behind' had as the salient pragmatic meaning:'behind' is behind a solid object. The deictic aspect of the meaning of the word was secondary and was ignored in favor of the relationship to a solid object as determining the meaning of 'behind' by the children who erred.

Conclusion

In conclusion, I want to restate the hypothesis--pragmatic then semantic. There are three stages in the development of semantic meaning.

1) Pure pragmatic stage. In this stage there is no separation of verbal meaning from the personal relations, action context. The utterance--whether the child hears it or produces it--is totally bound to the situation. The example previously quoted from Reich for 'shoes' is a perfect example.

A child who understands the three phrases: 'under the bed', under the table ' and 'under the chair' but who cannot locate under the tree, the car, etc., is another example. Such children have pseudo-concepts; they understand the phrases but do not have 'under' as a separate word. They know the word only as an element in an utterance which is bound to particular pragmatic encounters.

2) Pragmatic extension. The child understands the word in contexts which resemble the contexts of his/her pragmatic encounters perceptually, or in the kind of action he/she can perform to create the relation. The children in our research who could do 'under' and 'underneath' in our second experiment but not in our first are examples of children in the pragmatically extended stage.

3) Semantic stage. The abstract definition of the word is understood by the child although it probably cannot be verbalized. The word can be understood, the concept applied, in situations analogous only in terms of abstract relations to the situations of the child's pragmatic encounters with the word. The children who could do 'under' and 'underneath' on the first experiment as well as the second have arrived at the semantic stage for these words.

This is the course to semantic development in the case where the second stage represents underextension. We do not have the data which would indicate whether there are particular words or concepts , the understanding of which is likely to follow this course. Perhaps there is a personality factor that makes some children, hesitant to develop hypotheses as to semantic meaning on the basis of a very few pragmatic encounters, whose semantic development tends to fit this pattern. Roger Brown (personal

communication) has stated that Eve tended not to say things until she was sure she knew the right way, while Adam made more mistakes because he was not so cautious. Where a child jumps from the first stage to the third on the basis of inadequate evidence he may develop a false semantic. Reich's cases of overextension and mismatch, Brown's description of Washoe's semantic for flower(1970: 208) Clark's analysis of 'Bow wow' are all instances of false semantics for words. They are abstract, but either are based on the wrong aspect: smell as the quality abstracted from flower, or a too general meaning as with 'Bow wow'. False semantics tend to get corrected by negative reinforcement. The child is misunderstood or actually corrected in what he says. Brown reported (1973) that the mothers of Adam, Eve, and Sarah did not correct their children's grammar, but did correct for pronunciation and truth value of their utterances. A false semantic is one cause of lack of truth value.

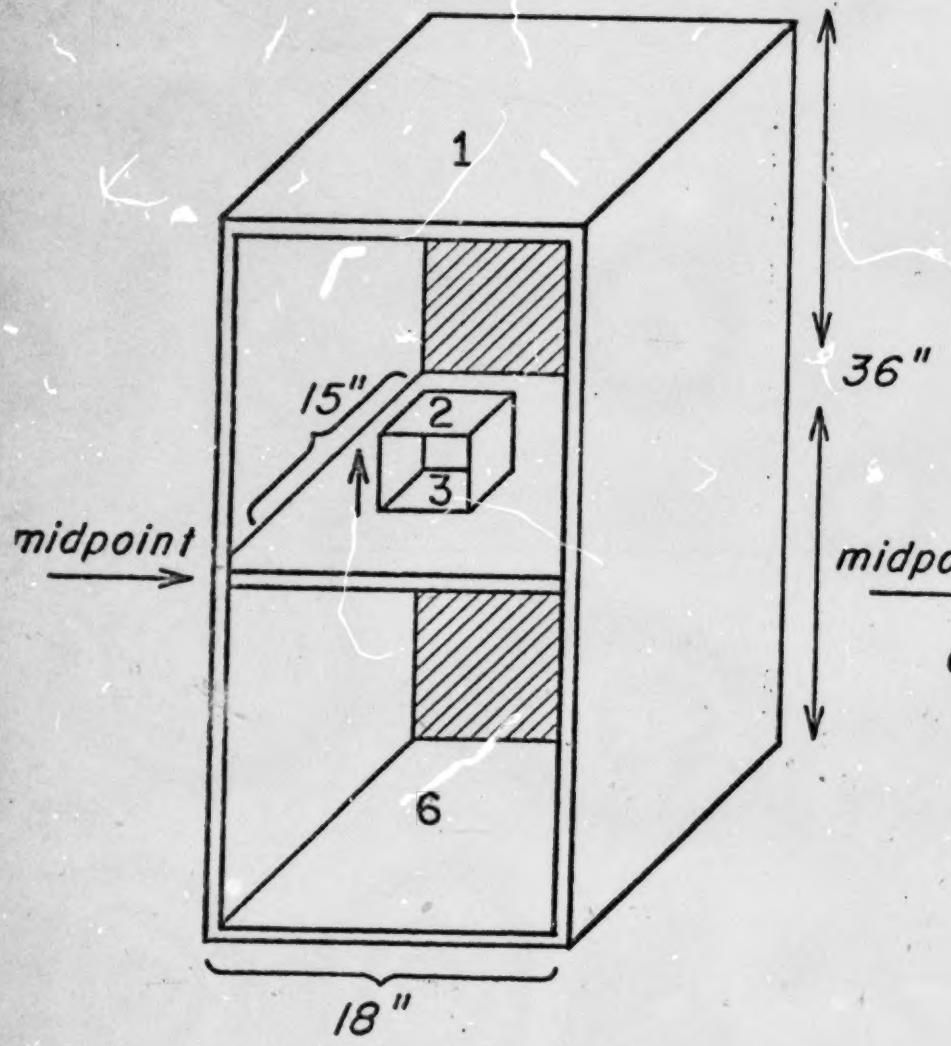
Throughout our lives, there are, for most of us, words for which we do not have a true semantic, just a meaning from a set of pragmatic encounters too limited to make it possible to precipitate out the correct abstract meaning of the word. For me, until recently when I looked it up in the dictionary, 'arcane' was such a word. It means secret, but for me it evoked a vision of savage rites of primitive tribes of long ago. I must have read 'arcane' in that context and did not encounter the word in enough different contexts to get rid of the initial context in which it was imbedded for me.

I want to claim that the similarity of our pragmatic encounters with words is a significant factor in our being able to communicate with each other, that it is at least as important as grammatical competence in the ability of native speaker-hearers. I have met European intellectuals

whose English grammar is perfect and who have extensive English vocabularies but who do not appreciate the songs of American pop writers, e.g. Tom Lehrer, because they did not grow up in the United States and so missed the pragmatic encounters necessary to understanding.

I want to express my thanks to Hillel Goelman who conducted the two experiments reported in this paper and to the children and teachers of the Eliot-Pearson Children's School for their cooperation with the research.

Structure, First Experiment



Structure Altered, Second Experiment

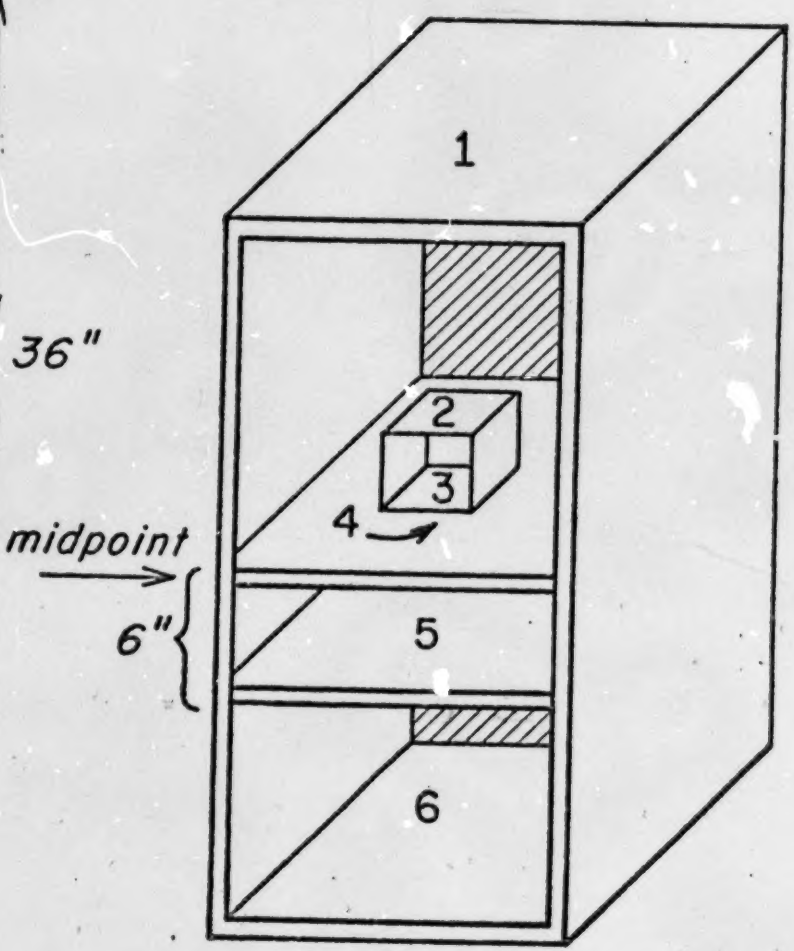


Table 1

Age and sex distribution of experimental subjects

Age	Girls	Boys	Total
7	1	0	1
6	1	5	6
5	10	11	21
4	16	18	34
3	3	4	7
2	0	1	1

Table 2

Number of children making errors and

types of incorrect responses Experiment I

reposition	in	next to	behind	in front of	on	no resp.	total	% of children N = 70
n	0	0	0	0	0	0	0	0
n	0	0	0	0	0	0	0	0
ext-to	0	0	1	0	0	0	1	1
nderneath	10	1	6	0	0	8	25	36
ehind	0	7	0	0	0	0	7	10
ver	0	5	3	3	0	4	15	21
utside of	0	0	0	0	0	0	0	0
elow	7	3	1	3	1	7	22	31
etween	4	0	0	3	0	4	11	16
n front of	0	8	4	0	0	1	13	19
above	1	0	0	0	0	5	6	9
eside	0	0	2	1	0	0	3	4
nside	0	0	0	0	0	0	0	0
nder	9	0	3	0	0	6	18	26
ut of	0	0	0	0	0	0	0	0
TOTAL	31	24	20	10	1	35	121	*

*% does not total because children make more than one error

Table 3

Types of incorrect responses

Preposition	in A	in B	next to A	next to B	behind A	behind B	in front of A	in front of B	on A	on B	no response A	no response B	total A	total B	% change in total
on	0	1	0	0	0	0	0	0	0	0	0	0	0	1	-
over	0	0	4	7	4	2	3	0	0	0	4	7	15	16	+07
underneath	9	12	0	1	6	1	0	1	0	0	7	0	22	15	-32
under	9	11	0	0	3	0	0	3	0	0	6	1	18	15	-17
below	7	2	3	5	1	1	3	7	1	0	7	4	22	19	-14
behind	0	0	7	10	0	0	0	0	0	0	0	0	7	10	+43
in front of	0	2	8	4	4	4	0	0	0	0	1	1	13	11	-15
TOTAL	25	28	22	27	18	8	6	11	1	0	25	13	97	87	

Note: 'A' refers to Experiment I; 'B' refers to Experiment II.

Table 4

A. Location used for 'underneath' 'under' and 'below' in the first and second experiments by all children who responded with the 'in' location (3) or did not respond in the first experiment.

Underneath				Under				Below			
Location				Location				Location			
1st	2nd	No.	%	1st	2nd	No.	%	1st	2nd	No.	%
3 & nr*	3	3	20	3 & nr	3	5	42	3 & nr	3	1	13
3 & nr	4	12	80	3 & nr	4	7	58	3 & nr	4	3	38
3 & nr	5	0		3 & nr	5	0		3 & nr	5	2	25
3 & nr	6	0		3 & nr	6	0		3 & nr	6	2	25
		15				12				8	

* nr = no response

B. Location used for 'underneath' 'under' and 'below' in the first and second experiments by all children who were correct in the first experiment.

Underneath				Under				Below			
Location				Location				Location			
1st	2nd	No.	%	1st	2nd	No.	%	1st	2nd	No.	%
6	4	28	94	6	4	27	71	6	4	2	7
6	5	1	3	6	5	9	25	6	5	30	80
6	6	1	3	6	6	2	4	6	6	5	13
		30				38				37	

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